

CLAIMS:

What is claimed is:

1. A method of treating a patient at risk of loss of cardiac function by cardiac ischemia, comprising

(a) imaging the patient's heart, or a portion thereof, to identify (i) an underperfused region of cardiac muscle, (ii) a source of oxygenated blood that is proximate a boundary of the underperfused region, and (iii) a target area that includes said underperfused-region boundary and a tissue expanse lying between said oxygenated blood supply and said boundary;

(b) at each of a plurality of sites throughout the target area, introducing a stimulus effective to stimulate angiogenesis in myocardial tissue and form a capillary network from the source of oxygenated blood to the underperfused region, wherein the stimulus is an injury produced by a stimulus selected from the group consisting of a mechanical, laser, chemical, thermal, or ultrasonic injury; and

(c) sustaining a demand for oxygen at the underperfused region for a period sufficient to convert the capillary network into an arterial network.

2. The method of claim 1, wherein the injury is produced by a mechanical cutting device effective to produce an annulus of injury about a core of healthy cells.

3. The method of claim 1, wherein the stimulus is a mechanical stimulus produced by introducing into each of said sites, a wire device having a barbed segment, and the method further includes periodically moving the wire devices relative to the heart, to produce a prolonged angiogenic stimulus at said site.

4. A method of treating a patient at risk of loss of cardiac function by cardiac ischemia, comprising

(a) imaging the patient's heart, or a portion thereof, to identify (i) an underperfused region of cardiac muscle, (ii) a source of oxygenated blood that is proximate a boundary of the underperfused region, and (iii) a target area that includes said underperfused-region boundary and a tissue expanse lying between said oxygenated blood supply and said boundary;

(b) at each of a plurality of sites throughout the target area, introducing a stimulus effective to stimulate angiogenesis in myocardial tissue and form a capillary network from the source of oxygenated blood to the underperfused region, wherein the source of oxygenated blood is one in which arteries less than about 1 mm branch into surrounding arterioles, and in which the arterioles with inner lumen diameters between about 50-200 microns are plentiful, and said sites are spaced from one another at spacing of between 0.5 to 1 cm; and

(c) sustaining a demand for oxygen at the underperfused region for a period sufficient to covert the capillary network into an arterial network.

5. A method of treating a patient at risk of loss of cardiac function by cardiac ischemia, comprising

(a) imaging the patient's heart, or a portion thereof, to identify (i) an underperfused region of cardiac muscle, (ii) a source of oxygenated blood that is proximate a boundary of the underperfused region, and (iii) a target area that includes said underperfused-region boundary and a tissue expanse lying between said oxygenated blood supply and said boundary,

wherein the underperfused region is in a myocardial region of either of the patient's ventricles, the source of oxygenated blood is the interior of the underperfused heart ventricle region, the target area includes the region of ventricle endocardium underlying the underperfused region, and said stimulus is a mechanical injury produced by forming at selected target sites in the target area, elongate channels in the endocardium of the ventricle, where the depth and width of said channels, combined with the blood turbulence produced within the ventricle, is such as to minimize accumulation of blood clot material in the channels;

(b) at each of a plurality of sites throughout the target area, introducing a stimulus effective to stimulate angiogenesis in myocardial tissue and form a capillary network from the source of oxygenated blood to the underperfused region; and

(c) sustaining a demand for oxygen at the underperfused region for a period sufficient to covert the capillary network into an arterial network.

6. The method of claim 5, wherein the channels have both width and depth dimension between about 1-5 mm.

7. The method of claim 5, further including the step of introducing an angiogenic growth factor into target-area sites between the underperfused region and adjacent portions of the inner ventricle wall.

8. The method of claim 5, further including the steps of
(d) imaging the heart to identify (i) as a second source of oxygenated blood, coronary arterioles in the epicardial region of the ventricle overlying the underperfused heart-ventricle region, (ii) as a second target area, the area between the second source of oxygenated blood supply and the underperfused region, and the adjacent boundary of the underperfused region; and
(e) introducing into the second target area, at selected sites therein, a stimulus effective to stimulate angiogenesis in the target area.